Two leaf analyses by Dr. Nathan Gammon, Gainesville, as of May 31, 1955, have shown 0.500 p.p.m. molybdenum (Mo) in normal hibiscus leaves, but 0.427 p.p.m. Mo in strap-leaf hibiscus leaves.

SUMMARY

Strap-leaf of hibiscus — a disorder characterized by malformed leaves and blossoms, and found on acid soils in Florida from Pensacola to Miami, and from Tampa to Daytona — has been corrected by the addition of five grams (approximately one teaspoonful) of molybdic acid or sodium molybdate in one gallon of water per plant applied as a foliar spray and soil drench. The addition of lime to the soil, along with the molybdenum, has lengthened the duration of the correction of molybdenum deficiency of hibiscus.

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EFFECTS OF READILY AVAILABLE N, P_2O_5 AND K_2O LEVELS ON GROWTH AND NUMBERS OF BLOOMS OF HIBISCUS PLANTS[1]

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The popularity in Florida of *Hibiscus rosa-senensis,* the common Chinese hibiscus, is well deserved. Few plants bloom as profusely and are as well adapted to the warm climate of Florida as the hibiscus. As early as 1926, Mowry (7) reported that the hibiscus was Florida's most widely planted shrub. A more recent Florida State bulletin on the hibiscus by Dickey (2) indicates that this plant is still the most popular shrub. It seems reasonably certain that the hibiscus will hold this lofty position among ornamentals in Florida for many years to come.

Varieties of hibiscus are numerous, but information on their nutrient requirements are scarce. Some studies have been made by Dickey (2, 3) on certain minor element deficiencies, which show up when the plants are grown on high-lime soils.

Little or no information can be found on the specific effects of the fertilizer elements, nitrogen, phosphorus, and potassium, on the growth and flowering of flowers and ornamental plants. It is generally agreed that to grow plants successfully, one should have at least a fair understanding of what can be expected of the nitrogen, phosphorus, and potassium that is applied to the soil. The effect of the soil on the availability of the fertilizers and the acidity of the soil has a decided effect on the growth secured from a given fertilizer or rate of application. A more intelligent use of the fertilizer can be made when these specific effects are better known. For instance, a nurseryman is interested in producing a compact plant with good foliage color, and one that flowers profusely if it is a flowering plant, as quickly as possible. The fertilizer requirements for growing plants in containers may be quite different from the same plant grown in the field. He should select and apply the fertilizer to meet this need. When the same container grown plant is set out in the garden, still another level of soil fertility may be more desirable. Here again, by the proper choice and use of a fertilizer, a major step is taken toward achieving these desirable growth habits.

[1]/Multiply P_2O_5 by 0.43 to change to phosphorus. Multiply K_2O by 0.83 to change to potassium.

Using the Spurway method for soil testing (9), Laurie and Kiplinger (6) did an extensive amount of research with a large variety of greenhouse grown plants. Their work formed the basis for much of our thinking on nutrient levels for flowers and ornamentals. Since this work was some of the earliest attempted, the method of reporting amounts of nutrients in parts per million in the extracting solution was established. As soil to extract ratios vary considerably among different analytical methods, the method of reporting results in parts per million in the extract has caused confusion and frequent errors when comparing results of soil tests. In order to standardize results, soil tests for amounts of readily available N, P_2O_5, and K_2O will be reported in this paper as parts per million in the soil.

It is the purpose of this paper to record the result of a study of the effects of N, P_2O_5, and K_2O in readily available forms on the growth and flowering of the hibiscus. Amounts of fertilizers applied will be recorded; however, no attempt will be made to correlate these amounts applied to the pots in the greenhouse to amounts required under field conditions. It is generally agreed that the difference in root-zone restriction and other factors make such a correlation impractical. For general information, a popular fertilizer formula will be suggested that appears to fall within the approximate ratio of total available N, and available P_2O_5 and K_2O as well as a comparison with Spurway equivalents.

Materials and Methods

Hibiscus rosa-senensis, single red variety, was chosen to represent a typical fast growing woody ornamental grown principally for its flowers. Plants were started from cuttings and allowed to grow for one month in sterile white sand. Uniform started cuttings were selected from this group and set in 5 gallon glazed pots which contained previously mixed soils and fertilizers. All of the plants were allowed to grow for 52 days in a greenhouse.

Lakeland fine sand, which may be classed as a well drained light sand, was selected for the experiment. This soil is known to be deficient in plant nutrients and organic matter as well. Allowances in the results should be made when considering other soil types having higher fertility values.

The basic fertilizer was a 1-1-1 *ratio using* an equivalent of 4 lbs. of a 6-6-6 formula per 100 sq. ft. This formula was selected because the low overall analysis allowed sufficient latitude for the addition of amendments of ammonium nitrate, superphosphate, and muriate of potash to the formula. Since it is important to maintain a good balance between the nitrogen, phosphorus, and potassium levels in the soil, the ratio formula and amounts were selected to meet this need as closely as possible. Each treatment was duplicated, making a total of 36 pots and 36 plants. The methods and amounts of fertilizers used for each treatment is given in Table 1.

Table 1

4 lbs. per 100 sq. ft. equivalent of the following fertilizers were mixed with the soil for each treatment.

Treatment No.	Nitrogen	Treatment No.	P_2O_5	Treatment No.	K_2O
1	0-6-6	7	6-0-6	13	6-6-0
2	1-6-6	8	6-1-6	14	6-6-1
3	2-6-6	9	6-2-6	15	6-6-2
4	6-6-6	10	6-6-6	16	6-6-6
5	18-6-6	11	6-18-6	17	6-6-18
6	30-6-6	12	6-30-6	18	6-6-30

Other factors that influence plant growth may be enumerated along with the method for their control.

Soil reaction: pH 6.2 to 6.5 was maintained by supplying calcium and magnesium from finely ground dolomite.

Minor elements: Maintained by mixing 4 lbs. per 100 sq. ft. equivalent of Ferro F.T.E. in the soil.

Moisture and light: Maintained as near uniform as possible with greenhouse facilities.

Method of fertilizer application: The fertilizer was mixed thoroughly with the soil prior to potting, except for nitrogen amendments, which were divided into 3 parts and applied at 17 day intervals.

Methods of soil testing: The soil sample was taken with a small sampling tube, composited, and extracted with a dilute sodium acetate solution. This solution has a concentration of 0.3N in total cations and is buffered to pH 4.75 with acetic acid. Although there are numerous requirements for a good soil extracting solution, a primary requirement that will insure reliable soil tests can be expected when the extracting solution is buffered enough so that it retains its initial pH value even after passing through a heavy type of soil. When this is true, both reference solutions and reagents may be readily standardized.

Because of the instability of various forms of tin and organic reagents used in the phosphorus soil tests, a modified phosphorus test and a new reducing agent were selected (5). Excellent quantitative results were obtained with a modification of Bray's nitrate soil testing powder (1). Nessler's reagent was used to test the soil for ammonia. The commonly used aqueous solutions of cobaltinitrite for potassium soil tests have been shown to give considerable error when subjected to changes in temperature (8). Therefore, it was necessary to develop a suitable potassium soil test for Florida temperatures (4).

Results and Conclusions

All figures in Table 2 represent the arithmetical mean of 5 separate soil analyses conducted at 10 day intervals. Curves for evaluating[1] each of the fertilizer elements studied are shown in Figure 1.

[1]/Using an index scale from 1-10, assigned values are equal to relative importance values. Relative importance values were assigned as follows: Foliage 1, Size 2, Flowering 3. These values are combined to give a total evaluation for the whole plant.

From the graph in Figure 1, it can be observed that the hibiscus plant showed a decided response to available nitrogen. The growth and size of the plant increased rapidly, reaching a maximum at 50 p.p.m. of available nitrogen in the soil. This was easily apparent from the color of the leaves. Where 4 lbs. per 100 sq. ft. equivalent of an 0-6-6 was mixed with the soil, the leaves were yellowish-green for the whole plant. The green color became more intense as the nitrogen levels approached the higher limits in the series. Plants receiving increased increments of P_2O_5 were darker green, more compact, and produced more flowers than plants receiving low levels of P_2O_5. Increased increments of P_2O_5 did not increase plant size proportionately. Increased increments of K_2O resulted in an increase in plant size but did not increase flowering in the same proportion as did increased increments of P_2O_5.

The results of the experiment suggest a fertilizer ratio of about a 1-2-2 or possibly a 1-2-3. Two popular mixed fertilizers that

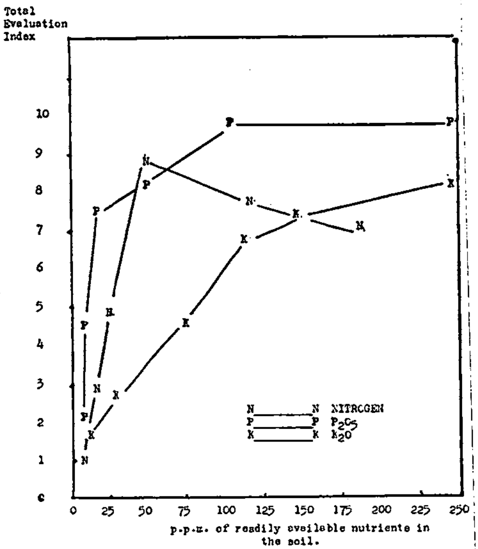
Table 2

Evaluation and Fertilizer Nutrient Levels for Pot Grown, Single Red Hibiscus

		Evaluations				Readily available nutrients	
Fertilizers Applied	Number Blooms	Flowers	Foliage	General Appearance	Total Evaluation	p.p.m. Extract (Spurway equiv.)	p.p.m. in soil
Total available NITROGEN							
0-6-6	2	1	1	1	1.0	1.7	10.0
1-6-6	5	2	2	3	2.3	2.5	15.0
2-6-6	17	3	5	7	4.7	4.2	25.0
6-6-6	71	8	9	10	8.7	8.3	50.0
18-6-6	60	7	8	8	7.5	19.0	114.2
30-6-6	55	7	7	7	7.0	30.7	184.5
P_2O_5							
6-0-6	4	1	4	3	2.2	0.4	5.8
6-1-6	28	4	6	5	4.7	0.6	8.0
6-2-6	38	6	9	9	7.5	1.2	17.2
6-6-6	42	7	10	9	8.2	3.4	47.1
6-18-6	82	10	9	9	9.5	7.7	105.8
6-30-6	81	10	9	9	9.5	18.2	250.7
K_2O							
6-6-0	5	1	2	2	1.5	0.8	6.0
6-6-1	9	2	3	4	2.8	2.8	20.4
6-6-2	15	4	6	6	4.5	10.3	74.5
6-6-6	42	6	7	7	6.5	15.8	114.0
6-6-18	52	7	8	8	7.5	20.0	144.0
6-6-30	54	7	9	10	8.3	34.6	249.0

Figure 1.

Growth Curves Showing the Effects of Nitrogen, P_2O_5, K_2O on Pot-grown Hibiscus



carry approximately these ratios are a 4-8-8 and a 4-8-10. When used as generally recommended, these fertilizers should supply sufficient phosphorus and the additional potash indicated by the experiment.

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INSECT PORTRAITS

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Photography is defined as the art of process of producing an image on sensitized surfaces by the action of light. This means that the one most important factor in taking pictures is proper lighting of your subject.

In other words your picture will never be any better than your lighting.

Proper exposure, which again is measuring your light, is necessary in taking pictures. Changing your lighting set up along with very accurate notes on how these pictures are made will be of great help to you. These pictures will serve to calibrate your light meter and camera so you can duplicate your results and establish a reliable technique.

I find that a Kodak Neutral Grey Color Card is very helpful. I get most of my light meter readings from the light reflected from this card. Beware of light reflected from surrounding bright or colored objects as they may ruin the value of your light meter reading.

The quality of sunlight changes during the day. Early and late evening color pictures will show reddish coloration.

Photographing a color chart will give you some interesting information. It is impossible to have several divergent colors in one picture and have all of them true.

It is best to expose for your subject and if it is right other parts of the picture will not be noticed. You must over expose for reds and under expose for blues.

But then this talk is on insect photography so let's see how we go about making *Insect Portraits,* and again we must go back to our sources of light.

Sunlight (natural light) has many faults. It is not always dependable. It may go under a cloud, and often your insects will not pose for you out in the open sun.

For some time I used sunlight for all of my pictures. That was many years ago, flash bulbs were expensive and strobe light was not yet invented.

With sunlight, and at times aided by a blue photo flood to fill in the shadows, I made